Cardiac Computed Tomography—Not Ready for Prime Time

Miller JM, Rochitte CE, Dewey M, et al. Diagnostic performance of coronary angiography by 64-row CT. N Engl J Med 2008;359:2324–36.

Study Overview

Objective. To establish the diagnostic accuracy of multidetector computed tomography (CT) angiography for identifying symptomatic patients with suspected coronary artery disease (CAD) who should be referred for coronary angiography.

Design. Multicenter, prospective cohort study.

Setting and participants. 405 patients aged ≥ 40 years recruited from 9 hospitals in 7 countries. Patients with a history of cardiac surgery, elevated serum creatinine, organ transplantation, dye allergy, aortic stenosis, atrial fibrillation, New York Heart Association class III or IV heart failure, coronary angiography within the last 6 months, and body mass index > 40 kg/m^2 were excluded.

Intervention. Patients underwent 2 multidetector CT tests (coronary calcium scoring and CT angiography) before conventional coronary angiography was performed. Raw image data sets from all acquisitions were analyzed by an independent core laboratory. Two independent observers visually graded the nonstented segments that were ≥ 1.5 mm in diameter. Conventional coronary angiography was performed within 30 days of CT angiography. All coronary segments ≥ 1.5 mm in diameter were analyzed using the 29-segment standard model.

Main outcome measures. Diagnostic accuracy of CT angiography as compared with the gold standard conventional coronary angiography, evaluated using the modified Duke coronary artery score and measured as the area under the receiver operating curve (AUC). Clinically significant stenosis was defined as ≥ 50% stenosis in ≥ 1 vessel.

Main results. Among the 405 patients enrolled, only 291 were included in the analysis. 89 patients had Agatston calcium scores > 600 and were excluded. Another 25 patients were excluded because coronary angiography was cancelled or technical failure of CT angiography. 56% of patients had obstructive CAD. The AUC for CT angiography was 0.93 (95% confidence interval [CI], 0.90–0.96) for the diagnosis of a patient with ≥ 1 coronary stenosis of ≥ 50% as determined by coronary angiography. The sensitivity for detecting obstructive stenosis was 85% (95% CI, 79%–90%) and specificity was 90% (95% CI, 83%–94%). The positive and negative predictive values were 91% (95% CI, 86%–95%) and 83% (95% CI, 75%–89%), respectively, for a disease prevalence of 56%.

Conclusion. Although the diagnostic performance of CT angiography was close to that of conventional coronary angiography, the negative predictive value of 83% suggests that 1 of 6 patients would be incorrectly diagnosed as not having CAD when in fact they did. CT angiography cannot replace coronary angiography in assessing the presence of obstructive stenosis.

Commentary

CT angiography may appear to be an attractive option to any physician who suspects CAD in a patient—simply scan a patient and determine whether obstructive lesions are present. If such a technology existed, the need for referral for the more invasive coronary would lessen. Currently, many patients with chest pain who are referred to the emergency department receive a plethora of tests to rule out coronary disease or pulmonary embolism [1]. If the use of CT angiography becomes routine, it may become another expensive test that is ordered without careful consideration of its value in helping clinicians triage patients.

Although this study by Miller et al demonstrates that CT angiography can detect obstructive lesions in symptomatic patients who were referred for coronary angiography, the data do not delineate how this technology could be used to improve patient outcomes. In addition, given the positive and negative predictive values of CT angiography (91% and 83%, respectively), it appears that it should not be substituted for conventional coronary angiography and would simply be another expensive test performed before definitive angiography. Although noninvasive, CT angiography comes with risks, specifically exposure to contrast dye and radiation [2], and therefore its use must be carefully considered. It is also important to note that the study population was carefully selected, and broader use of CT angiography may limit the diagnostic accuracy demonstrated in this cohort.

Applications for Clinical Practice

At present, it is unclear who would benefit from CT angi-

ography. Symptomatic patients with CAD may ultimately need the gold standard coronary angiography to determine the extent of disease. In light of the additional dye and radiation that patients would be exposed to if they underwent CT angiography, its use cannot be recommended for evaluation of symptomatic patients at this time.

—Review by Salomeh Keyhani, MD, MPH

References

1. Gallagher MJ, Raff GL. Use of multislice CT for the evaluation of emergency room patients with chest pain: the so-called "triple rule-out". Catheter Cardiovasc Interv 2008;71:92–9.
2. Redberg RF, Walsh J. Pay now, benefits may follow—the case of cardiac computed tomographic angiography. N Engl J Med 2008;359:2309–11.